Stability and Variability in Interactive Behavior as Measured by Methods of "Speech Chronemics" [1)]

Hans-Peter Krüger, Annette Stuckenberg and Mark Vollrath
University of Würzburg

Abstract

Dyadic interaction is modelled as an adaptive process between personality of the partners involved and the characteristics of the theme. The theme structure and the principles which control the adaptation process are referred to as "syntality". The material of the studies reported are the speech signals of the verbal interaction reduced to an on-off pattern. In a first study individual speech behavior was found to remain stable in dyads even if partners changed. The second study showed the stability of the speech patterns for different interaction themes even if dyads changed. These apparently contradictory results are reconciled by introducing the concept of "adaptive stability". Individual speech behavior does not happen at a stable activity level, but is characterized by a constant relationship ("less" or "more") to the respective activity of the other partner.

Introduction

Elements of interaction: two persons and one 'theme'

The outcome of an actual dyadic interaction is determined primarily by the personality characteristics of the two partners. Another source of influence is the content of the interaction and the way it is translated into behavior. When one examines the actual "phenotypes" of interactions, it soon becomes evident that their large variability can be reduced into a much smaller number of "basic interactions". Their communicative contents are linked with different scenarios, are realized by different "interaction

scripts". These "genotypes" of interaction will be referred to as "themes". The double sense of this term is intended: "theme" means a topic or subject matter as well as a recurrent melody or a time sequence of events.

In the fine tuning process that occurs during such an interaction the characteristics of these three elements must be alligned and adapted to one another. For the special case of conversations this tuning process has been referred to variously. Webb (1972) proposed "synchrony," Cassotta, Feldstein, and Jaffe (1967) "pattern matching," Giles, Taylor, and Bourhis (1973) "interpersonal accommodation" (this term in a broader sense is also favored by Crown & Feldstein, 1981). But irrespective of terminology we have to understand: Which personality characteristics and which demands specified by the theme are adaptive and variable, which are stable and constant and what are the specific features of the required fine tuning process?

For example: a flirtation between persons A and B is characterized primarily by the personalities of both A and B. Quite independently of personality, however, the flirtation theme requires a special set of behavioral elements different from those needed for other themes, e.g., for a quarrel. Moreover, the theme is also an operating instruction, a general arrangement (analogous to a musical score) of actions and reactions. Hence, a theme is characterized by a stable set of behavioral elements (or "traits") as well as by a set of process controlling principles. Thus, from a methodological standpoint the structure of a theme may be viewed in the same way as a personality; and therefore, after Cattell (1948), we have referred to it as "syntality" and have introduced it into the discussion of social behavior (Krüger, 1988).

Figure 1 displays the elements involved in dyadic interaction: two personalities (A and B) and one syntality (S). Each of these is characterized by stable features that must be synchronized in time, organized in quality and quantity, to produce an "interaction". A necessary precondition of this process is that subsets of the three feature sets A, B, and S are variable. Only these subsets are available to the actual phenotype of an interaction. Thus, our theoretical framework conceptualizes dyadic "interaction" as the time course of a fine tuning process between three preexisting, relatively stable elements.

We also have to understand the tuning processes which lead to the mutual adaptation of A, B, and S. The functioning of these processes has been studied by Duncan and Fiske (1977). They also reviewed the literature. Cappella (1985) has given a comprehensive

overview of studies on the tuning that lead to "controlling the floor" in conversation. Recently, studies on "interaction rhythms" have dealt with these problems (e.g., Davis, 1982; Street & Cappella, 1985).

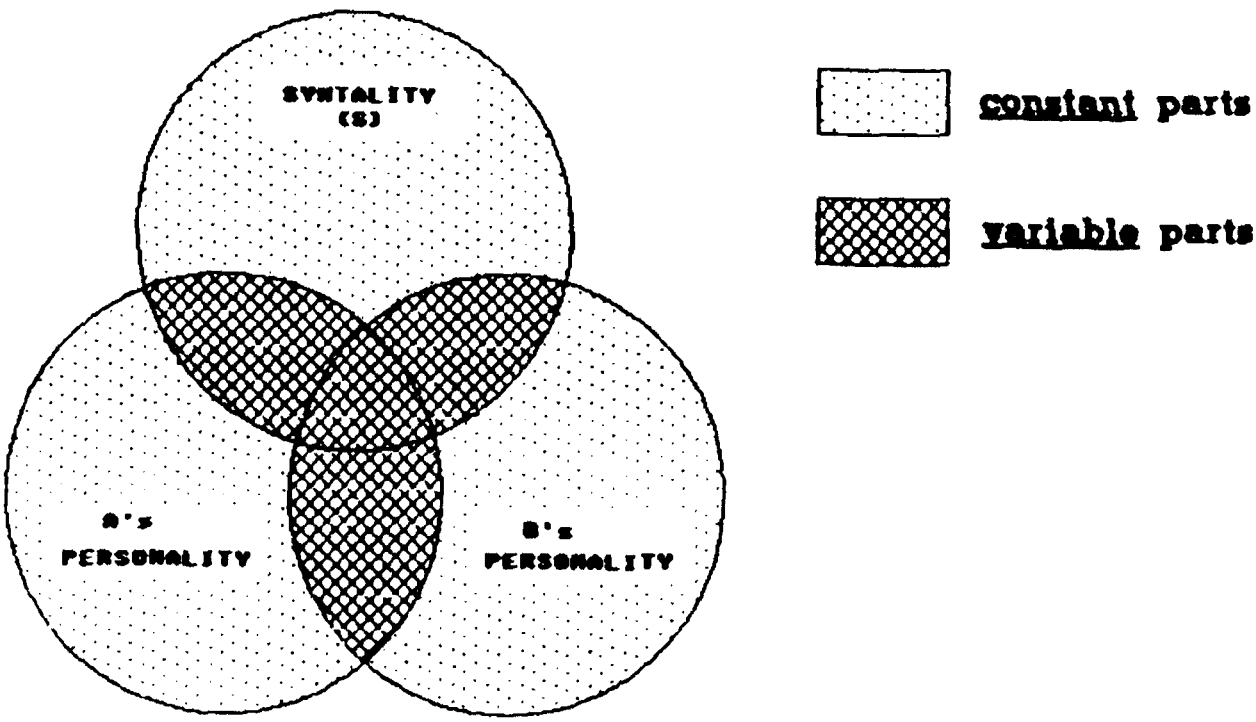

Figure 1. Elements Involved in Dyadic Interaction.

The present research is concerned with three questions:

(1) Stability of individual behavior (personality): to what extent does a person consistently show the same behavioral elements in repeated interactions?

(2) Stability of syntality: how can we discriminate between different "themes" of interaction and how consistently are these "themes" shown in interactions between different partners?

(3) Mechanisms of fine tuning: what are the principles of the fine tuning process that mediates between the two stabilities?

The methodological approach: speech chronemics

Adaptation can certainly be observed at several qualitative and quantitative levels of behavior, in both verbal and nonverbal communication. The behavioral basis of our methodology is the recording of speech. Figure 2 conceptualizes vocal behavior as a subset of interactive behavior. Speaking has two information carriers: semantics and nonverbal characteristics. We look at the latter by evaluating the physical property "signal energy" by purely objective and instrumental methods. The continuous flow of energy is transformed into a discontinuous on-off pattern of "speaking" and "pausing". The speech signal is thereby reduced to a parameter that measures the time pattern of speaking behavior.

Krüger (1988) has introduced the term "speech chronemics" to characterize this methodological approach. Chapple (1939) with his "Interaction Chronograph" was one of its pioneers. The most refined methodology has been developed by the "Baltimore school" of Jaffe and Feldstein (1970) with their "Automatic Vocal Transaction Analysis" (Cassotta, Feldstein & Jaffe, 1964). Feldstein and Siegman have documented results obtained by use of this methodology and have integrated them into the appropriate research areas in their handbooks "Multichannel Integrations of Nonverbal Behavior" (Siegman & Feldstein, 1985) and "Nonverbal Behavior and Communication" (Siegman & Feldstein, 1987).

Apparatus and methodology

The present investigations of dialogues made use of specialized equipment. Condensor microphones were affixed to the subjects' throats to get a recording free of crosstalk. Signals were tape recorded. In some cases we used a direct registration and evaluation of the signals, using a portable device called LOGOPORT (Krüger, 1985; 1987). Both methods amplified the current of the microphone, high pass filtered and rectified it. Then, the signal was compared every millisecond to an adjustable threshold and an on-off pattern was produced. Every 8 ms there was a check whether there were more than 2 "on" units of 1 ms. If so, the total 8 ms span was classified as "speaking"; otherwise as "pause". All studies applied the same speed resolution and digital filter.

Figure 3 depicts the transformation of physical energy to a behavioral time pattern. The energy course of the speech signal (line A in Figure 3) is transformed into an on-off pattern with a resolution level of 8 ms (line B). To improve signal detection

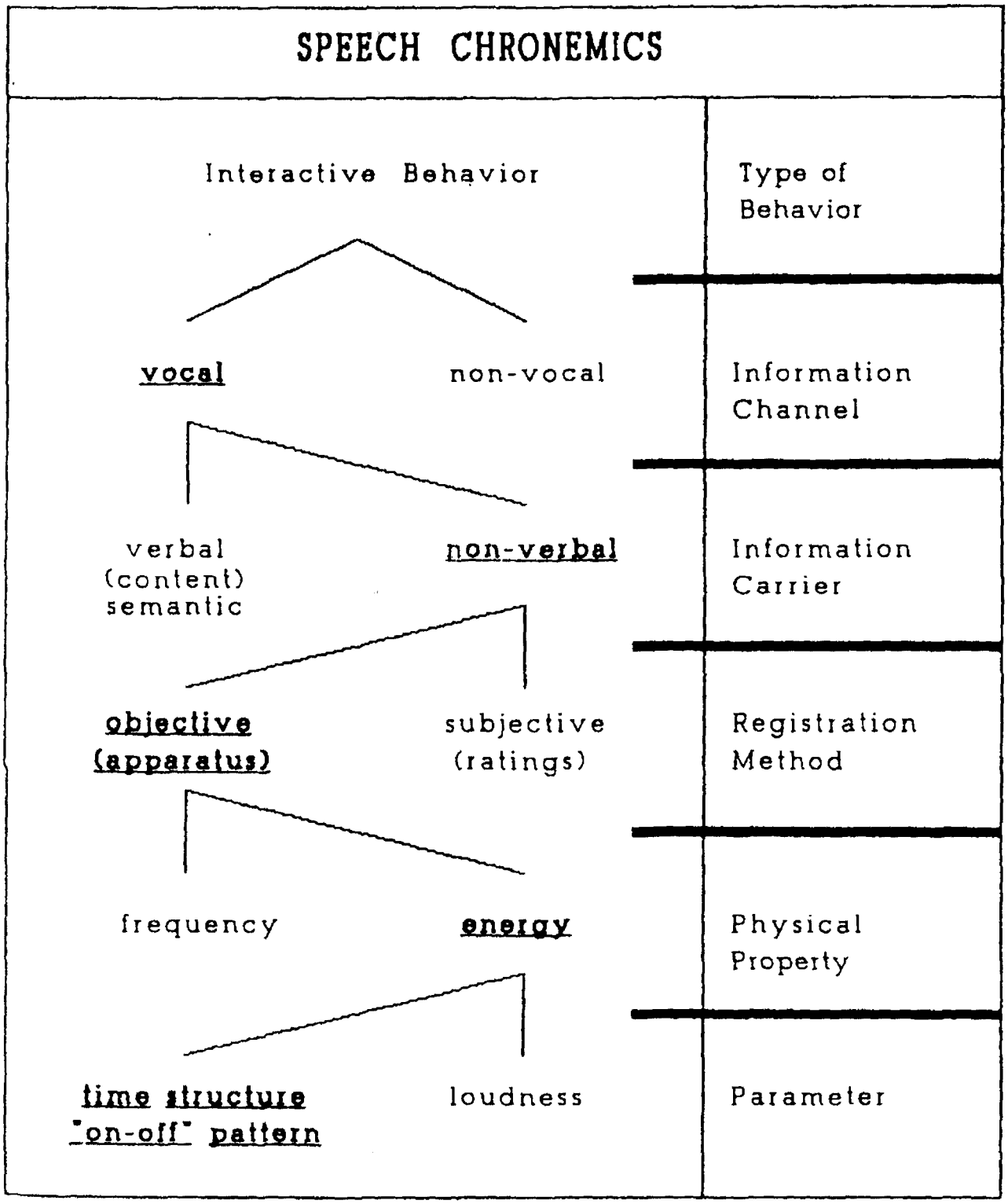

Figure 2. Operationalization of "Speech Chronemics".

from noise all sequences of "ons" or "offs" shorter than 40 ms are eliminated (line C) applying similar considerations of Brady (1965). Thus, pauses shorter than 40 ms embedded in speech are classified as belonging to the speech sequence and vice versa.

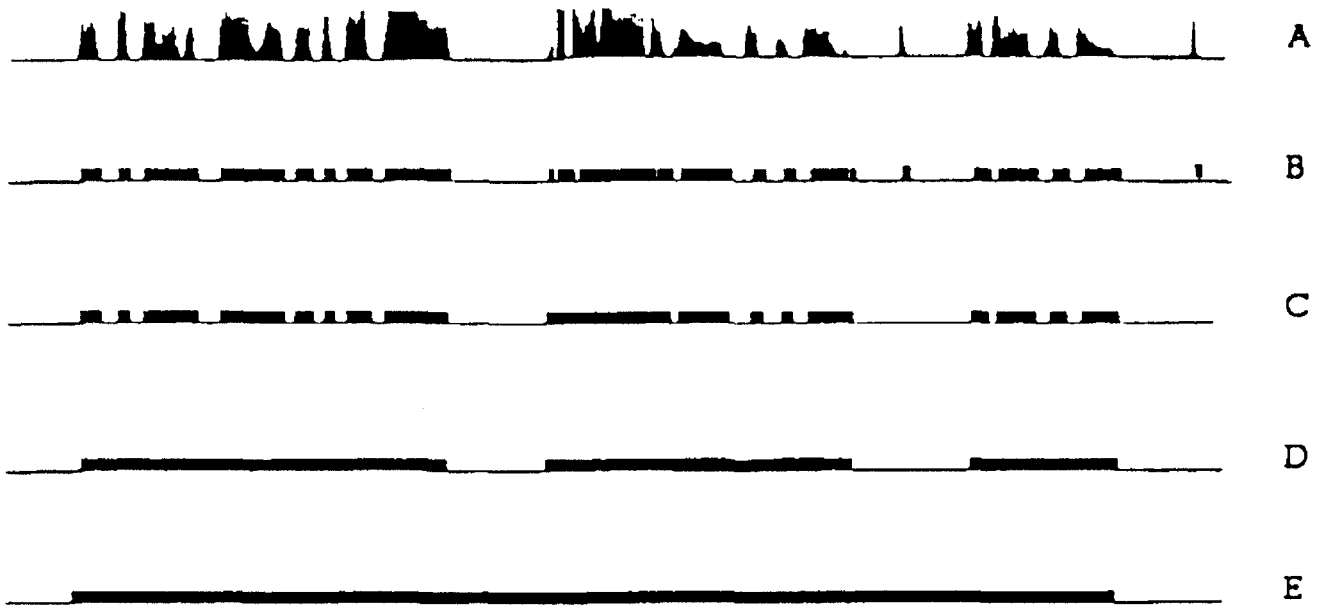

Figure 3. The Transformation Process from Physical Energy to Behavioral Time Patterns at Different Time Levels. Duration About 6 Seconds per Line.

A: Energy of recorded speech signal.
B: Signal transformed to on-off pattern.
C: Pauses and speech up to 40 ms disregarded (events are phonations and articulation pauses).
D: Same as for C with change up to 200 ms (events are vocalizations and pauses between vocalizations).
E: Same as for C with change up to 800 ms (events are utterances and pauses between utterances).

Duration of pauses depends on a variety of processes in speech production. The shortest pauses required by our speech motorics to produce "p", "t" or "k", the so-called plosives, are about 80 ms in duration. If these pauses are qualified as speech (by using a fill-in procedure) as in line D the next temporal unit of duration in speaking emerges: clusters of phonemes which constitute a "phonemic clause" of about 1 to 1.5 seconds (Trager & Smith 1951). By qualification of even longer pauses up to 800 ms as speech (line E), the next unit emerges: utterances of about 4 to 6 seconds in duration. These different time levels in speech, their statistical evaluation and their psychological significance are described in Krüger (1988).

The present investigations make use of information as depicted on line E. In the analysis of dialogues a variety of events can be distinguished as shown in Figure 4. The two lines represent the time course of the speaking activity of two interacting partners. The temporal events can be classified into reflexives and non-reflexives ones. The latter ones are durations of utterances, pauses between utterances, speech in isolation, interruptions, and pauses in isolation.

Here, the activity of each partner is characterized by one parameter value. Durations of mutual silences and double talk (simultaneous speech), however, are the same for the two partners. The following description of results focuses on these parameters and on the percentage of time speaking.

The following studies are part of a larger research program that has involved the collection of a variety of mosaic pieces. Together, these may yield a picture of interactive behavior. Therefore, we do not attempt to get representative and large samples of subjects in each single study. We have preferred a heuristic evaluation of many results from small samples and from a variety of situational contexts. This approach can better take into account the huge variability of social behavior and of our actual knowledge about it than a "nomothetic" procedure developed for testing hypotheses. Therefore, whenever statistical significance is reported below, it is to be understood and used as heuristically.

Stability in personality and syntality

To analyze the stability of personality and syntality only one source of variance should be operative at one time: either the personality of a changing partner or the syntality of a changing theme. Therefore, we have conducted studies in which the same subject A talked at various times about the same theme with the same partner or with another partner (stability of personality A) as well as studies in which pairs of subjects talked with each other about different themes (stability of syntality).

Retest-reliabilities of speech behavior

Experiment 1 attempts to determine stability of speech behavior with the same partner as well as with different partners. Subjects were a group of six male and another group of six female American students between 17 and 22 years of age. Within each group all $n*(n-1)/2=15$ possible pairs of subjects (= dyads) talked about "preparation for a final exam" in a seperate room.

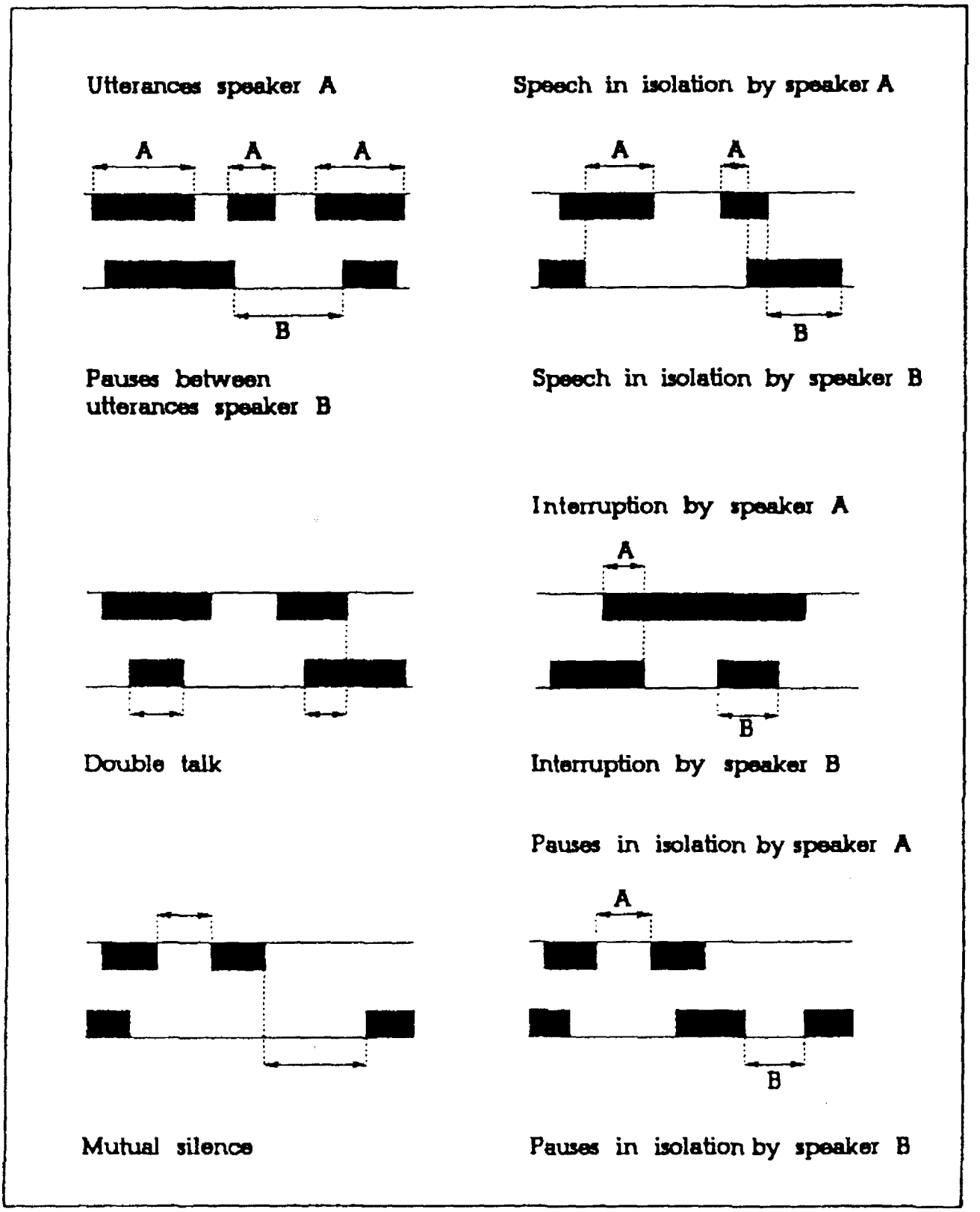

Figure 4. Temporal Events in Dyadic Interaction

Thus, at occasion 1 each subject has had five conversations. Thereafter, the two groups were randomly recombined into two new groups each consisting of three men and three women. Again, in both new groups all possible dyads talked about the same topic as before (occasion 2). A single conversation lasted for about 7 minutes.

Figure 5 shows the two same-sex and mixed-sex groups. Obviously 4 submatrices can be distinguished within the mixed-sex groups: male subjects talking with male partners (MM), male subjects talking with female partners (MF), female subjects talking with male partners (FM), and female subjects talking with female partners (FF).

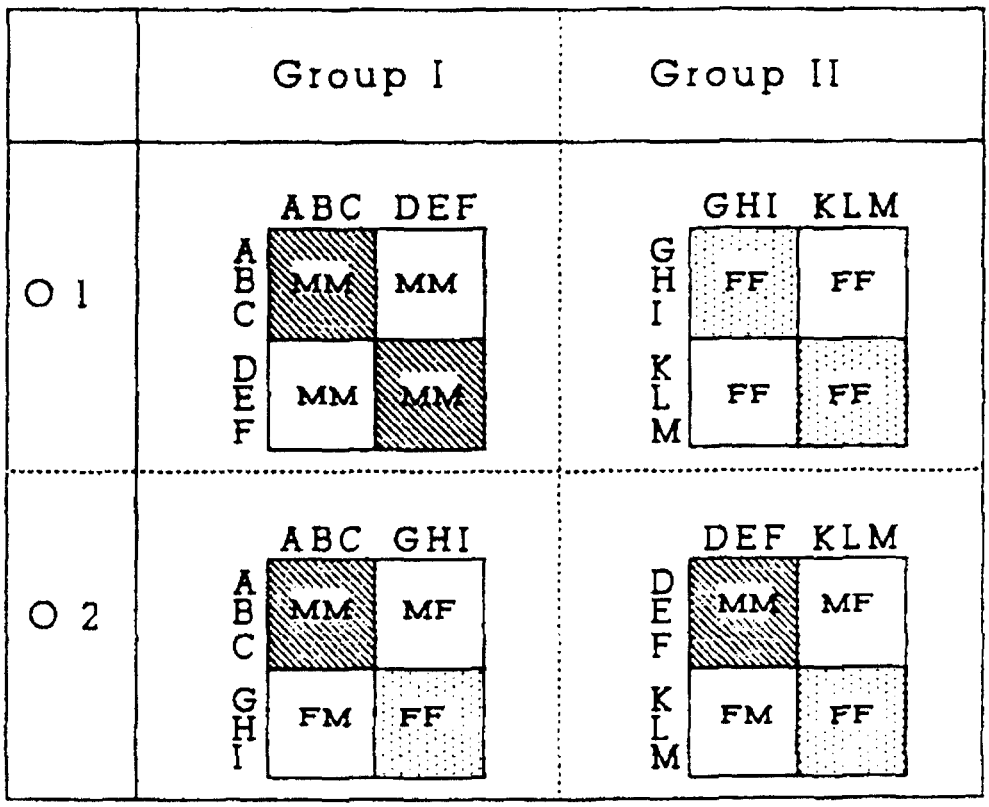

Figure 5. Design of Experiment 1.
O1/O2: First and second occasion.
A-F: Male speakers.
G-M: Female speakers.
MM: Men conversing with men, FF: Women conversing with women, MF: Male conversing with women, FM: Women conversing with men.

The shadowed submatrices contain dyads, which have been repeated twice.

The dark submatrices include the dyads which have been repeated. Here the same partners have discussed the same topic twice (at occasion 1 and 2). The parameter values a subject has had in the first and at the second occasion have been correlated in order to obtain retest-reliabilities. They are displayed in the first column of Table 1.

To estimate stability of individual behavior (personality) we used the light submatrices. Here subjects conversed with different partners; at occasion 1 with three same-sex partners; at the second occasion with three opposite-sex partners. The average parameter values for occasion 1 are correlated with those of occasion 2. For instance, the arithmetic mean of subject A in the conversations with D, E, and F was correlated with his mean in the conversations with G, H, and I. These correlations are given in the second column of Table 1.

Table 1. Reliabilities Based on the Means for a Number of Parameters

Parameter	Partner of same sex	Partner of opposite sex
% of time speaking	.66	.71
Utterances	.55	.82
Pauses between utterances	.64	.72
Speech in isolation	.56	.73
Double talk	.43	.34
Interruptions	.30	.18
Pauses in isolation	.18	-.11
Mutual silence	-.18	-.01

Stability was found to be very high (and significant at the .01 level) for the parameters percentage of time speaking, duration of utterances, duration of pauses between utterances, duration of speech in isolation, and duration of double talk. Coeffi-

cients were slightly higher in the condition "different partner". No stability could be found for the two pause parameters: pauses in isolation and mutual silence. Both are quite dependent on the behavior of the other partner rather than under the control of the speaker.

Since the theme of the conversation ("preparation for a final exam") was held constant, this level of stability can be interpreted as indicating stable individual behaviors. Behavioral elements such as duration of utterance or double talk evidently occur at acomparable rate when subjects converse with the same partner as well as with other ones. These findings confirm results reported by Krüger (1986) and by Marcus, Welkowitz, Feldstein and Jaffe (1970). The latter authors analyzed the speech behavior of 24 female college students in repetitive dialogues with the same as well as with other partners. Despite the differences in methodology (they used a resolution speed of 300 ms) as well as in their parameter definitions. Table 2 demonstrates a pretty good correspondence to our findings.

Table 2. Comparison of Reliabilities from our Experiment (Würzburg) With Data from Marcus, Welkowitz, Jaffe and Feldstein (Baltimore) for Comparable Parameters. The First Term Designates the Parameters Used by the Baltimore Authors.

	Same partner		Different partner	
Parameters	BALTIMORE	WÜRZBURG	BALTIMORE	WÜRZBURG
Vocalizations/ utterances	.68	.55	.72	.82
Pauses/pauses between utterances	.65	.64	.33	.72
Simultaneous speech/ double talk	.30	.43	.12	.34

The results yield evidence that basic features of the individual speech behavior are stable personality characteristics and are fairly independent of the behavior of other partners.

Syntality: its constancy and variability

In the previous Experiment 1 the theme was held constant. Will the subjects change their behavior when the theme changes? Remarkably little has been done toward answering this question. Reviewing the literature we found nothing like a cartography of verbal behaviors. What are the basic themes? How do they differ one from another? Or to put it in terms of personality theory, we miss a "structure of syntality".

In Experiment 2 we introduced as a first approach the two dimensions "evaluation" (positive - neutral - negative) and "dominance" (one partner dominant - balanced). The 2 x 3 combination yielded 6 themes (see Table 3). The balanced themes were flirtation (positive), small talk (neutral), and quarrel (negative). The dominant themes were dating (positive, the female speaker A was dominant), searching for the train station (neutral, the male speaker B was dominant), and complaining (negative, the female speaker A was dominant).

Table 3. Utterances and Pauses Between Utterances for the Six Themes of Experiment 2 (Mean Value in ms).

Dominance	Evaluation	Themes	Sex	Utterances	Pauses between utterances
Balanced	Positive	Flirtation	A F	2564.7	6840.0
			B M	2960.7	5439.1
	Neutral	Small talk	A F	2631.0	5943.3
			B M	2318.0	5896.8
	Negative	Quarrel	A F	7659.2	3233.7
			B M	5200.2	4312.8
Unbalanced	Positive	Dating	A F	2612.1	5139.1
			B M	2536.7	8382.9
	Neutral	Searching	A F	2679.5	10243.6
			B M	3478.0	2496.3
	Negative	Complaining	A F	8033.9	4207.0
			B M	3272.3	6119.5

The balanced themes have been:

Flirtation: A couple met for the first time last evening and had dinner together. During the course of the dinner an attraction for each other developed. This development is reflected in the conversation. It could well be described as a flirtation.

Small talk: Two friends (a boy and a girl) meet in a bar by chance. They talk about current events and sports and what has happened, and they gossip about their friends. They don't discuss serious matters.

Quarrel: A husband coming home after work finds that the house is a mess. He starts to blame his wife. The wife listens as her husband gets angrier and angrier. Then she counters. A bitter argument follows. Both insist on their side of the story.

The dominant themes have been:

Dating: At a party a man meets a woman for the first time and engages her in conversation. They are attracted to each other. The man would like the woman to meet him for dinner the following day. In this situation the woman is the person who has to decide whether they will meet each other again or not.

Searching for the train station: A woman is searching for the train station. She asks the first person she meets for direction. The man notices that the women is a foreigner. He tries to describe the way clearly.

Complaining: After work a couple comes home together. Both have had a very hectic day and are worn out. He goes straight to the bar, mixes a drink for himself and sits down to read the newspaper. But she has to prepare supper. She puts the blame on him. The man feels guilty and humiliated; he knows his wife is right.

These themes were role played by eight german students between 23 and 28 years of age in 4 mixed-sex pairs. Each pair played all themes after a practice period.

Data analyses of this, the previous and the following studies, yielded 8 speech parameters for each experimental condition. Table A of the appendix summarizes the results of all three experiments.

Mean and standard deviation were calculated for each parameter over these eight conditions. Then data were transformed into standardized Z-values with Z = 100 + 10 z. These standard scores are depicted as profiles that now can be understood directly as "lower" or "higher" than average. The row order of parameters is the same for all profiles: first the percentage of time speaking, then the four parameters of speaking, then the three of pausing.

We will first present the results from the two themes flirtation and quarrel. Figure 6 contrasts the speech parameters for the two themes.

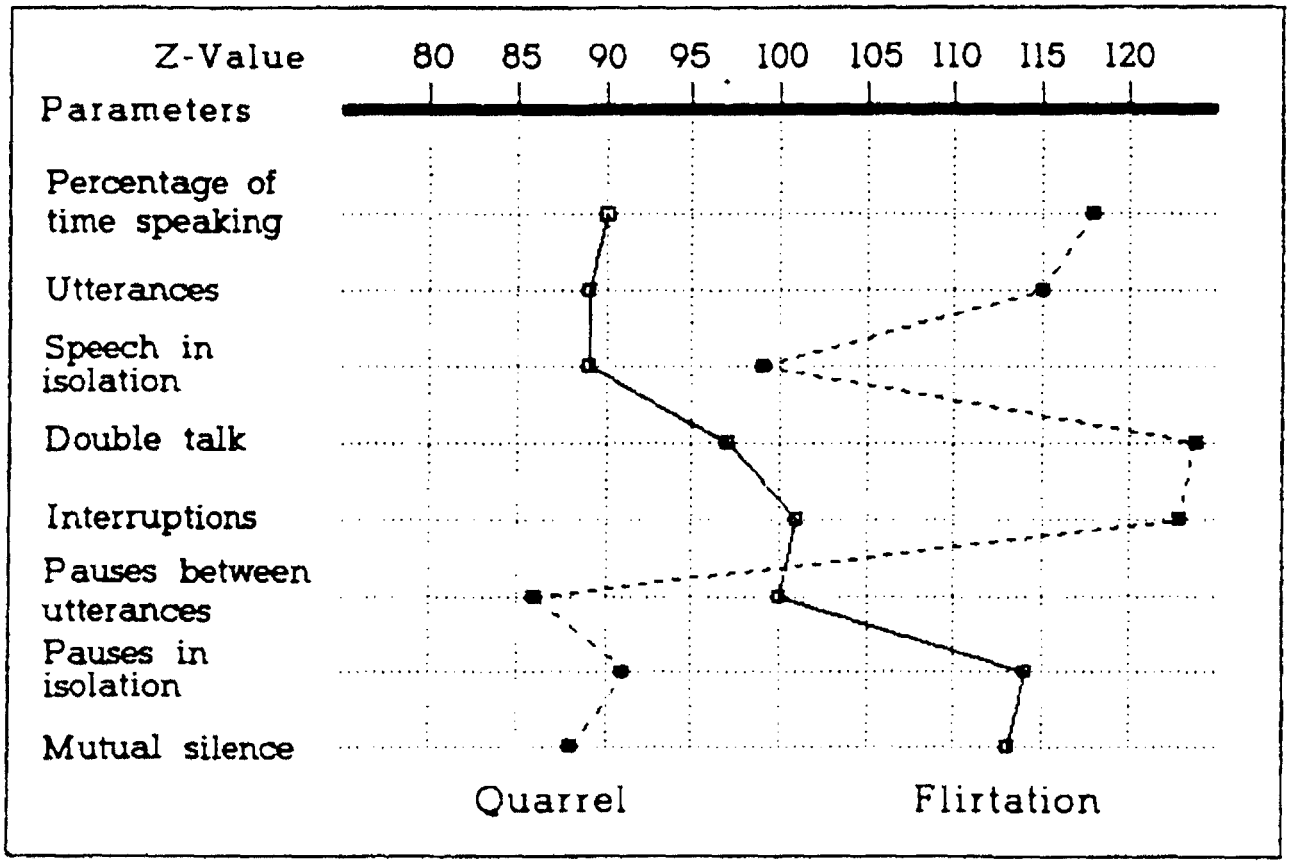

Figure 6. Z-Values of Speech Parameters for the Two Themes Quarrel and Flirtation (Data From FRG)

A flirtation is characterized by a small percentage of time speaking, short utterances, little (!) speech in isolation, long pauses in isolation and long mutual silence. This theme is characterized by tentative behavior: An utterance is terminated at once if the partner interrupts; nobody wants to take the floor. In contrast, quarreling is essentially a struggle for dominance and is

accordingly characterized by long utterances and interruptions, long double talk and short pauses. The differences are extraordinary: Columns 5 and 6 of Table A in the Appendix show that the parameters of speaking during quarreling are approximately twice as long as during flirtation. Pauses during quarreling are half as long as during flirtation.

Clear differences were also found between the other themes. Table 3 shows the results for utterances and pauses between utterances. It should be noted that gender has to be interpreted cautiously in the unbalanced themes because here gender is confounded with a special role.

Long duration of utterances is obviously used to exert negatively evaluated power over the other partner: the activities of both partners in the quarrel theme and speaking behavior of the accusing partner (A) in the complaining theme is characterized by long utterances. On the other hand, the average duration of pauses between utterances is longer in positive themes and when one partner is submissive.

The previous analysis demonstrated the variability (and its face validity) of speech behavior concerned with different themes. The reliability of these different profiles as given by the set of eight speech parameters is an independent question. If the profiles reflect stable interaction patterns, their realization by different role players must not differ too much from one another.

First, the eight profile parameters were calculated separately for each of the eight subjects (in four pairs) for each of the six themes. To eliminate individual differences, the six values that were measured for each subject in the six themes were Z-standardized. This was done for each of the eight speech parameters. Thereby, level and spread of subjects and parameters were equalized. Then, the parameter profiles of all subjects who played the same role were intercorrelated for each of the six themes. The resulting six correlations were averaged by a Z′-procedure. This was done for partner A and partner B of each pair. Also, for all non-reflexive parameters (i.e., all except double talk and mutual silence) the Z-sum of A and B (A+B) and the Z-difference between the two partners (A- B) was calculated and correlated as above. Results are given in Table 4.

Coefficients for all themes are comparable to the coefficients for persons, reported in the previous section.

Table 4. Correlations for the Six Themes.

Dominance	Evaluation	Themes	A (Female)	B (Male)	A+B	A-B
	Positive	Flirtation	.71	.34	.97	-.23
Balanced	Neutral	Small talk	.75	.58	.93	.15
	Negative	Quarrel	.90	.78	.97	.08
	Positive	Dating	.62	.62	.84	.17
Unbalanced	Neutral	Search. train stat.	.89	.52	.97	.98
	Negative	Complaining	.85	.13	.97	.84

The reliability of the Z-sum is quite high. This sum reflects the partners' common activity regarding the theme. The difference A-B measures the asymmetry of speech behavior. Reliability must be low in the balanced themes because here neither a positive nor a negative difference is reasonable. The unbalanced themes however should have high coefficients as they involve "searching for the train station" and "complaining". The low coefficient for "dating" results from the fact that the women were more active in this role play than instructed.

The stability of the interaction patterns in these dyads raises two questions: How many different interaction patterns can be characterized within the methodology of speech chronemics? What kind of developmental processes do we have to assume to understand syntality?

The first question requires the establishment of a taxonomy of themes that is fully based on behavioral features. Psychology has quite a number of cognitively oriented taxonomies of themes (e.g., Argyle, Furnham & Graham, 1981; Orlik, 1987, in keeping with the methodology of Bales). On the other hand, we have Barker's tabulation of "behavior settings" (1968), defined by objective features and not by behavioral elements as required for our purposes. Thus, an "ethogram of man" following the principles of ethometry (see Tembrock, 1980, 37 ff.) is still lacking. Some beginnings can be found in the work of human ethology (see Eibl-Eibesfeldt, 1984).

The second question is still more challenging for psychology. The obvious ubiquity and stability of interaction patterns must be

ascribed either to a genetic (ultimate) determination of behavior or a determination based on learning (proximal). As Mayr (1974) points out, the former approach is highly plausible: "Since much of the behavior directed toward other conspecific individuals consists of formal signals, and since there is a high selective premium for these remarks to be unmistakable, the essential components of the phenotype of such signals must show low variability and must be largely controlled genetically" (p. 657).

The methodological problem of determining this genetic portion entails on one hand research on early human development and on the other hand the comparison of behavioral sequences in different cultures. In a first step (Experiment 3) we compared American to German students. Two American pairs role played the same themes as their German colleagues. Their results can be found in column 7 and 8 of Table A. They are depicted as flirtation and quarrel in Figure 7 and should be compared with Figure 6.

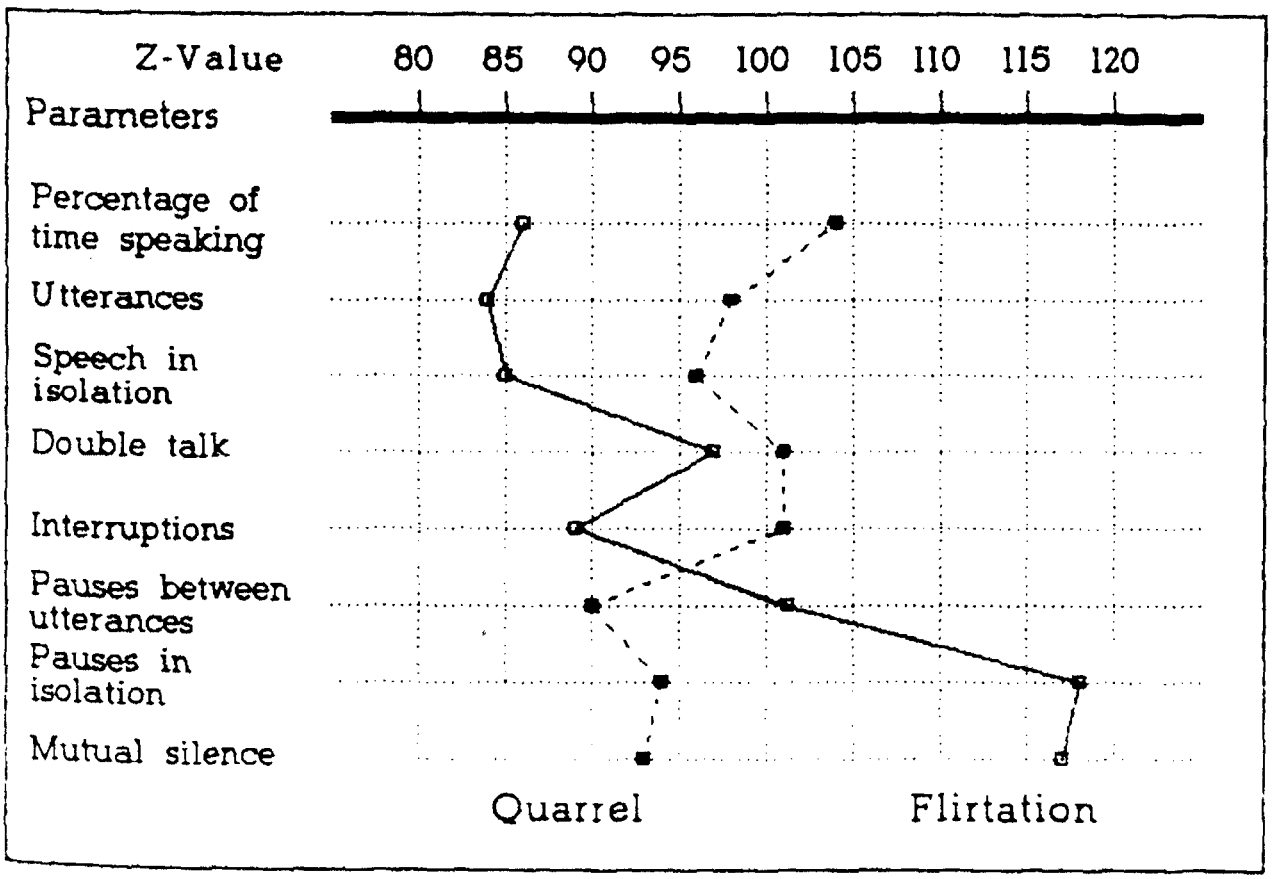

Figure 7. Z-Values of Speech Parameters for the Two Themes Quarrel and Flirtation (Data from USA).

The shape of the two US profiles is the very same as that of the two FRG profiles. The only difference is that the German students showed more extreme values when quarreling. Encouraged by results like this, we are preparing comparisons with other cultures.

Stability revisited: the consistency of differences

In summary, we have found high retest reliabilities indicating stable differences between persons. On the other hand, we have also found that themes determine a large portion of the speech pattern of all subjects. The following section combines these two approaches and integrates them under the rubric of consistency.

Evaluation of consistency

The apparent contradiction between the two stabilities can be resolved by returning to the research design presented in Figure 5. At the first occasion we have had two same-sex groups. At the second occasion we recombined them into two mixed-sex groups. Table 5a gives the average durations of the pauses between utterances for the women on the first occasion. The rows show the parameter values of a subject when contacting with the partner of the column. E.g., subject H had pauses averaging 10836 ms in duration when talking with G, but only 4444 ms when talking with K!

The variance in the rows as well as between the row totals is extremely large. The consideration of the fact that an interaction is a process involving two (!) partners reveals the structure of the matrix. We compared the values of the two conversing partners which can be found symmetrically to the main diagonal of the matrix. In Table 5 b those comparisons were made: We assigned a "+" to the larger value and a "-" to the smaller value. The sum of the "+" in the rows depicts that there are differences between the subjects. That is, some subjects always have the longer pauses, some always the shorter ones.

Rearranging the matrix of comparisons (dominance matrix) of Table 5 b into the order of the row sums yields Table 5 c. A perfect hierarchy with no circular triads (intransitivities) would be represented by an upper diagonal matrix only with "+". An appropriate descriptive measure is Kendalls coefficient of consistency which varies between 0 (no consistency) and 1 (perfect consistency) depending on the number of triads. Coefficients were calculated for each of the four experimental groups of Figure 5. Table 6 gives the results.

Table 5. Matrix from Subjects G-H with Pauses Between Utterances and its Transformation into a Dominance Matrix.

Table 5 a

	G	H	I	K	L	M	Mean
G	0	4824	3880	5533	5184	3434	4571
H	10836	0	7509	4444	9293	6532	7723
I	7006	5427	0	4805	9003	5383	6325
K	10298	10359	6452	0	10758	5648	8703
L	6162	4776	5501	4687	0	3309	4887
M	10436	6064	8131	7410	11309	0	8670
Mean	8948	6290	6295	5376	9109	4861	

Table 5 b

	G	H	I	K	L	M	Sum (+)
G		-	-	-	-	-	0
H	+		+	-	+	+	4
I	+	-		-	+	-	2
K	+	+	+		+	-	4
L	+	-	-	-		-	1
M	+	-	+	+	+		4

Table 5 c

	H	K	M	I	L	G	Sum (+)
H		-	+	+	+	+	4
K	+		-	+	+	+	4
M	-	+		+	+	+	4
I	-	-	-		+	+	2
L	-	-	-	-		+	1
G	-	-	-	-	-		0

Table 6. Kendall's Consistency Coefficient for the Groups MM: Male Talking with Male, FF: Female Talking with Female (Groups at Occasion 1 in Figure 5), M1, M2: First and Second Mixed-Sex Group (Groups at Occasion 2 in Figure 5).

Parameters	MM	FF	M1	M2
% of time speaking	1.00	.89	.77	1.00
Utterances	.54	.77	.89	1.00
Pauses between utter.	1.00	.89	.77	.77
Speech in isolation	.43	1.00	.89	1.00
Interruptions	.31	.43	.43	.26
Pauses in isolation	.20	.43	.77	.31

Consistency can only be calculated for parameters that are not the same for the interaction partners per definitionem; hence, double talk and mutual silence are excluded. With the exception of "interruptions", consistencies in all groups are very high ($p(K)=>.77)<=.05$). The large variability in the absolute values collapses into a simple structure with high consistency when relativized. Therefore, consistency in the social context must be redefined: stability now comes to mean not a constant level of behavioral activity (level stability) but a constant relationship to the respective activity of the other partner (hierarchy stability)! More succinctly, social power is not to be found in speaking long, but in speaking longer.

This result emphasizes the importance of the tuning processes mentioned above. Level stability needs less sophisticated processes of synchronization than hierarchy stability. During an interaction an on-going analysis of one's own and one's partner's behavior has to be maintained in order to establish and stabilize this hierarchical order. One's own behavior must be adapted quickly and efficiently to the varying cues coming from the other partner and the theme.

Gender differences in speech chronemics

The design of our first study (Table 5) also allows an analysis of gender specific behavior. Table A in the Appendix gives the average parameter values for the four interaction pairings male-male (MM), male-female (MF), female-male (FM), and female-female (FF). There Z-transformed measurements are displayed in Figure 8a and 8b.

The intra-gender behavior as shown in Figure 8a differs only in the duration of the pauses: Women make longer pauses than men. The inter-gender communication (Figure 8b) is characterized by a higher percentage of time speaking, longer utterances, and more speech in isolation of the women talking with men. Men talking with women show longer pauses between utterances. Evidently, in the context of our study, the women were more active and dominant. This may be due to the youth of our subjects, to the fact that they were not acquainted well with one another and to a situation comparable to a first date. All these factors may result in a more submissive male behavior. This effect is particularly evident when our flirt-quarrel data of Experiment 2 are analyzed for gender differences. Therefore, we calculated the differences of the Z-values between men and women. Figure 9 depicts the resulting differences.

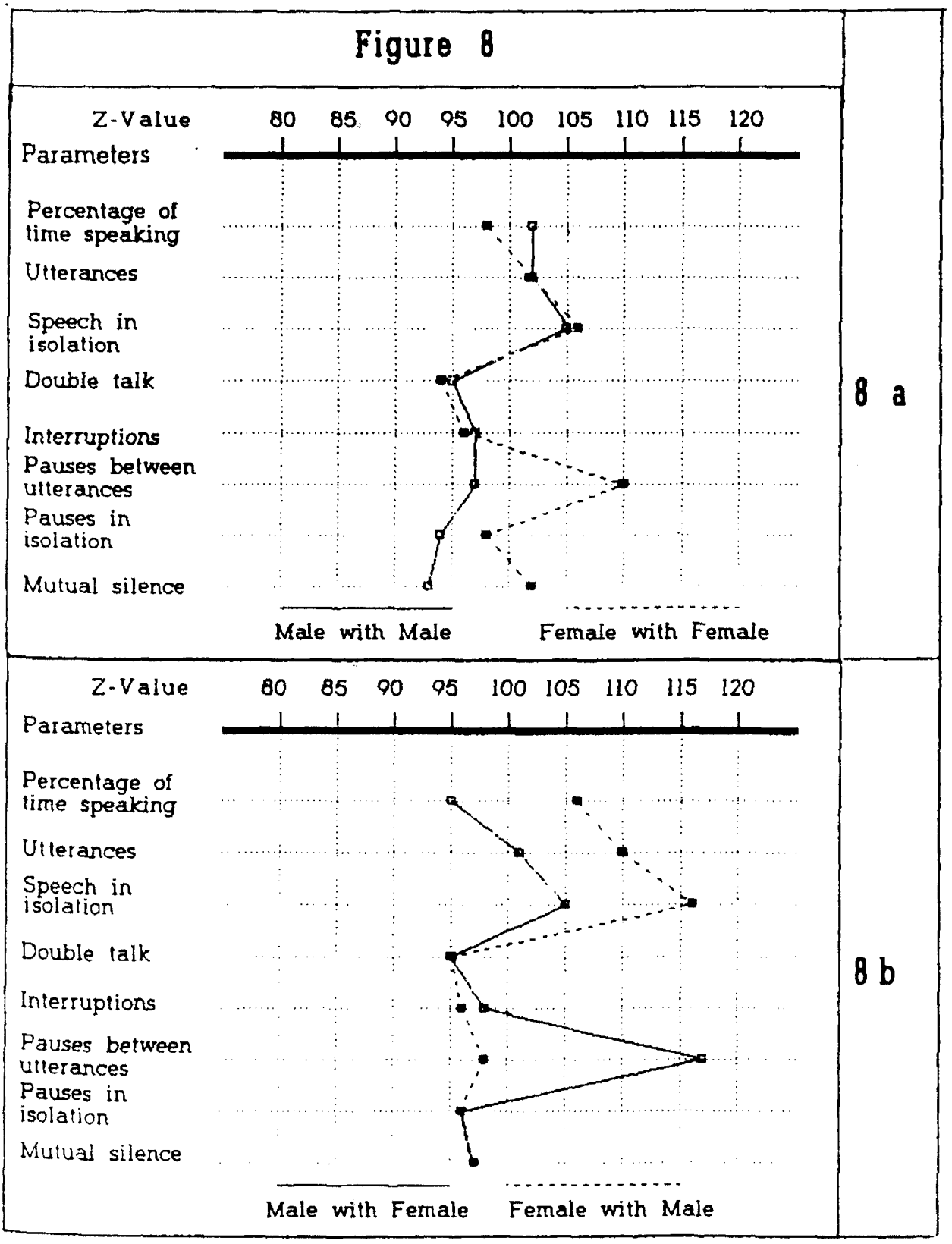

Figure 8. Z-Values of Speech Parameters for Different Partners.

When quarreling, men use shorter pauses in isolation, less speech in isolation, shorter utterances, and a smaller percentage of time speaking, but longer pauses between utterances. Thus, the male quarreling behavior seems to be less dominant. When flirting, men however use shorter pauses between utterances as well as longer pauses in isolation. This activity pattern indicates a more dominant male behavior. Therefore, existence and direction of gender differences depends on the theme. These differences can only be determined when the social situation is controlled by the experimenter, as Hall (1985) pointed out after an extensive review of the literature.

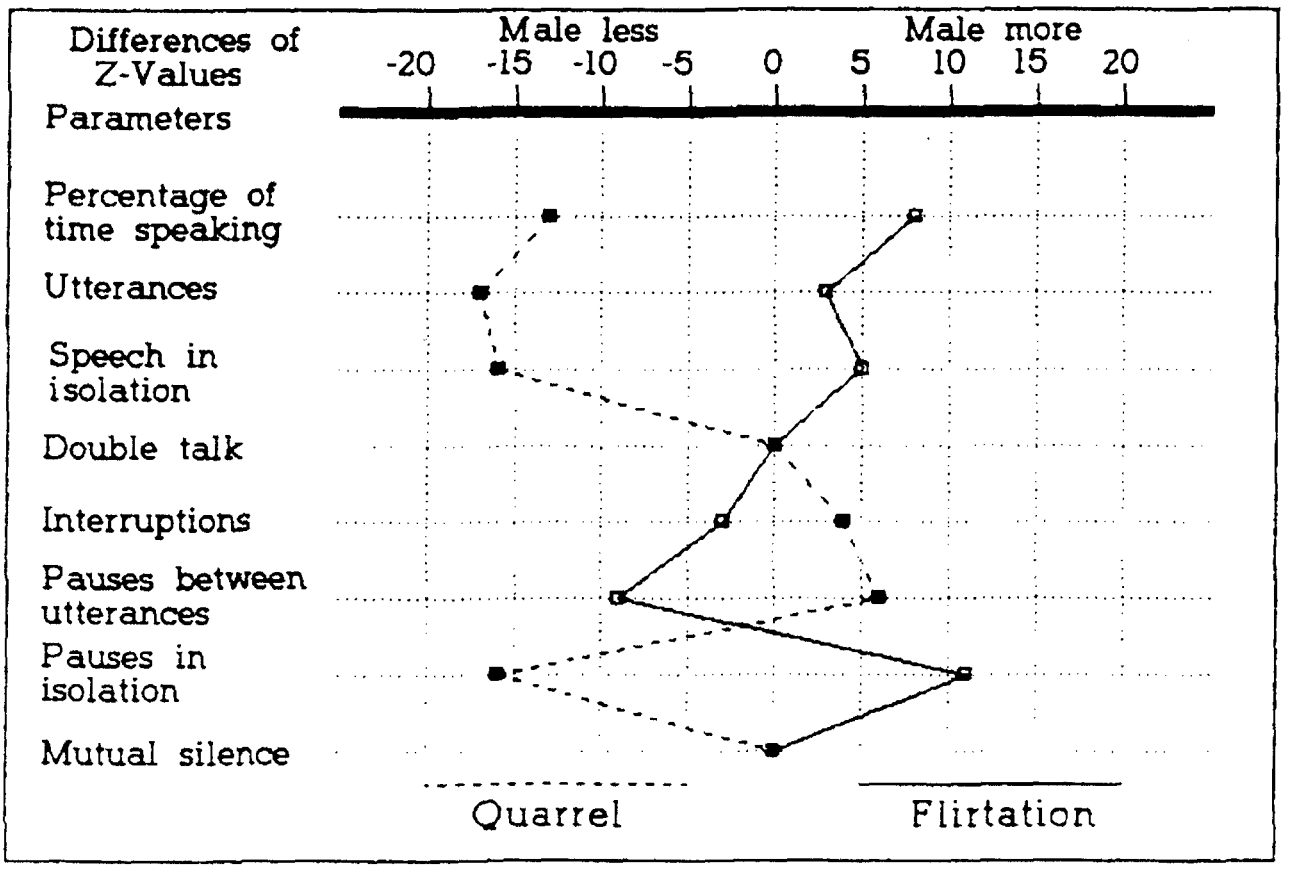

Figure 9. Differences of Z-Values for the Two Themes Quarrel and Flirtation (Male-Female).

Three questions concerning syntality - a program for research

To answer the questions with which we began:

- Individuals show a high stability in their interactive behavior as measured by speech parameters if the theme remains constant (or at least comparable). Therefore, speech behavior patterns are an integral component of personality.

- Speech parameters discriminate between different themes. They must be considered, therefore, to be stable principles controlling the fine tuning process.

- These two results are in apparent contradiction to one another. Consistency analysis provided the resolution: Social behavior is not stable in level but stable in order (hierarchy): Interaction behavior is adaptively stable.

How can these results be integrated into a theoretical framework? The beginning of this century witnessed a comparable empirical situation in the case of the psychology of perception. The prevailing approach at that time, oriented to elements and their combinations, was empirically confronted with the mysterious "Gestaltqualitäten" of Ehrenfels (1890). He had shown that sequences of events arranged in time (like a musical theme) can be transposed in level (key) and spread (measure) without changing their basic character (melody). Gestalt psychology identified these qualities as functional dependencies between elements. If these elements are organized in space, "Gestalten" are perceived; if they are organized in time, "movement" (like the phi phenomenon) is the perceptual result.

Lewin (1951, p. 189 f.) introduced these principles into social psychology. He emphasized the unique nature of the group, independent of its members but functionally organized by them; and thus he created 'group dynamics'. The independence of the group from its members claimed by Lewin is well demonstrated by the studies of Dabbs, Ruback and Evans (1987). When analyzing group conversations, the empirical facts forced them to add to the individual speech measures a new class of parameters describing the behavior of the group itself: group turns, group pauses, group switching pauses.

The accomplishment of Gestalt psychology was to strip away the mystery from the perception of "Gestalten" by demonstrating their

empirical conditions. Lewin released social psychology from mysterious entities like "group mind" and reduced such concepts to their empirical base. In the very same way we must find a methodological approach to ´syntality´.

Three questions clearly arise:

- The "technical" question: Interaction has to be produced by the two interactants. It is the result of a tuning process which itself must be described by psychology. Promising clues as to how to do so are given in the handbooks edited by Davis (1982) and Street and Cappella (1985).

- The "semantic" question: How many different syntalic structures can be isolated (e.g., aggressive, friendly, and so on). Are they quantitatively different (e.g., strong vs. weak)?

- The "genetic" question: Syntality is based on an interdependence of two behaviors which must be interlocked like a zipper. This must be analyzed in its phylogenetic (co-evolutionary and ultimate) and ontogenetic (learning dependent and proximal) development.

Notes

1) We are indepted to Daniel Robinson for providing laboratory facilities that enabled us to run our U.S. experiments and to Daniel C. O´Connell for his advice in carrying out the study and his hints in preparing this article.
Requests for reprints should be sent to: Prof. Dr. Hans-Peter Krüger, Department of Psychology, University of Würzburg, Röntgenring 11, D-8700 Würzburg, FRG.

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Table A. Appendix A

Column No.	Partners 1 MM	2 MF	3 FM	4 FF	Themes 5 Flirt. (FRG)	6 Quarr. (FRG)	7 Flirt. (USA)	8 Quarr. (USA)	Overall 9 Mean	10 SD
Parameters										
% of time speaking	44.5	37.3	49.0	40.6	31.6	61.4	27.4	46.1	42.2	10.6
Utterances	4577.1	4431.4	5807.7	4588.0	2762.7	6429.7	2138.6	4061.8	4349.7	1417.1
Speech in isolation	3954.6	3949.4	5144.2	4119.8	2339.6	3361.1	1868.5	3101.7	3479.9	1047.4
Double talk	931.0	920.2	920.2	899.8	1004.9	1943.5	999.3	1138.4	1094.7	351.6
Interruptions	910.2	960.2	893.9	888.8	1079.0	1954.1	613.2	1078.9	1047.3	394.2
Pauses between utterances	5559.7	8928.3	5820.8	7716.7	6139.5	3773.2	6228.3	4495.5	6082.7	1646.9
Pauses in isolation	1324.9	1452.5	1423.4	1560.9	2418.6	1163.3	2625.9	1350.9	1665.1	544.0
Mutual silence	1087.2	1311.8	1311.8	1602.4	2209.6	750.7	2458.1	1082.4	1476.8	586.1